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ABSTRACT

This paper provides a brief overview of some of the current thought on teaching problem-solving and decision-making skills and presents selected exercises that have been used successfully in a graduate course in problem-solving and decision-making strategies. In addition to learning theories that are presented in order to help learners understand various types of problems and research related to problem-solving and decision-making strategies, the paper includes several paradigms that adult learners have found helpful in improving their problem analysis, solution generation, and decision-making skills. Techniques discussed include general problem-solving strategies, structured problems, ill-structured problems, exercises in defining and analyzing problems, idea-generating techniques, techniques for making better choices, techniques for identifying implementation blocks, and observations about the roles of reason and intuition in problem solving. An appendix to the report contains problem-solving and decision-making techniques and related learning activities. (KC)

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PROBLEM SOLVING AND DECISION MAKING STRATEGIES FOR ADULT LEARNERS

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PROBLEM SOLVING AND DECISION MAKING STRATEGIES FOR ADULT LEARNERS

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Thinking and rational decision making are the essence of being human and the hallmarks of being an adult. They are pervasive activities in our daily lives...from half-wake thoughts in the early morning as we decide whether to awaken or go back to sleep to lingering thoughts at the end of the day which help us decide that it is safe to fall asleep. In between, decisions, some made almost automatically, others after laborious consideration, guide every action of our day. This paper provides a brief overview of some of the current thought on teaching problem solving and decision making skills and presents selected exercises which have been successfully used in a graduate course in problem solving and decision making strategies.

The underlying assumption in teaching rational thinking skills is that adults are rational decision makers. That is, decisions <u>always</u> are made on the premise that the chosen alternative offers the best probability of the highest payoff; the largest amount of something that the individual values. Therefore, higher quality decisions will result when the decision maker(s) (1) has clearly defined the desired outcome, (2) identified an adequate range of acceptable alternatives, (3) evaluated each alternative in

terms of its probability of providing maximum value, and (4) has a plan for implementing the decision.

In addition to learning theories which will help you understand various types of problems and research related to problem solving and decision making strategies, the workshop will teach you several paradigms which adult learners have found very helpful in improving their problem analysis, solution generation, and decision making skills.

Throughout the paper, terms such as reasoning and problem solving are used in a generic sense. Reasoning can be thought of as a complex bundle of skills which assess evidence, appraise conflicting claims, critique ideas, and build arguments. Problems are broadly defined as perplexing situations, those in which there is a perceived need to make a decision, to close a gap between what is and what should or could be. A decision is a choice among alternative actions, one of which is to delay making a decision. Decisions may relate to initiating new activities or to re-evaluating the status quo for potential improvements. Whether consciously made or not, the decision not to decide is, obviously, a decision to stay with what is. Techniques will be presented for both individual and group decisions.

General problem solving strategies

Problems range from simple, single solution situations to complex, multiple outcome problems where there is diversity of opinion as to which outcomes should be maximized.

School-based approaches to learning critical thinking skills usually emphasize more structured problems for which the problem objective is clear, there is a single correct solution, and there is a solution paradigm or process for finding the solution. An example would be the cold logic of a geometrical proof which is verifiably either correct or incorrect.

Adults, however, often face emotionally laden decisions which lack clear criteria for success or failure. Unfortunately, as Simon (1973) points out, all the important social, political, economic, and scientific problems of the world are of this fuzzy, ill structured nature. Their fuzzy nature arises from the decision maker(s)' uncertainty or ambivalence in prioritizing or weighting multiple outcomes, from errors made when estimating the probability that a given action will result in the desired outcome, from incomplete information and some degree of uncertainty, and, frequently, from the need to consider the decision's impact on several classes of stakeholders. Two examples from personal decision making are the dieter's choice between dessert tonight or, possibly, a slimmer figure next month. Or, the car buyer's multiple trade-offs betwen quality and price, comfort or fuel economy, carrying capacity or pizzaz of a sporty model.

In group decisions, additional fuzzies enter the decision process. In an organization, for example, resource

allocation is usually a zero-sum game; what one gains another loses. Ideally, decisions should be based on optimum short and long term outcomes for the organization. From this standpoint, the problem could be classified as a complex structured problem and subjected to analysis with mathematical techniques. However, given the realities of life in organizations, decision makers must also consider political implications, such as who wins and loses. In evaluating decision alternatives in terms of potential outcomes for one's personal future, who wins or loses may be far more important than the organizational consquences of the decision.

At the public policy level, which will not be discussed further in this paper, decision making rules are even more elusive. There are multiple publics, conflicting values, high levels of risk, and a great deal of uncertainty about consequences of major policy changes. This results in a great deal of reluctance to change existing policies. There are prolonged delays in the decision making process and temporizing moves are made through small incremental changes.

Making fuzzy decisions is a holistic experience, an interaction of mind, body, and feelings. Although good decisions are still based on logic and clear analysis, solution requires a higher degree of creativity and aesthetics of judgment because the problem is not clearly

stated, needed information is not available, there is no readily available solution algorithm, and it rarely can be demonstrated that one solution is better than another.

Although problems will be divided for discussion purposes into structured and ill structured or "fuzzy" problems, it is readily apparent that this is an arbritrary decision. Problems range along a continuum from highly structured to extremely fuzzy. However, solutions to all types of problems can be improved by instruction and practice. Our purpose here is to present some exemplary strategies, give examples, and suggest learning exercises which may be appropriate for adult learners under differing decision conditions.

Structured problems

Gagné (1985) believes that there are three necessary conditions for solving structured problems: (1) the intellectual skills, knowledge of concepts and rules related to the problem; (2) ability to develop an adequate problem schemata, understanding of what the problem is and is not; and (3) a planning strategy which enables a problem solver to select and put in proper order the intellectual skills that will achieve the goal of the problem statement. This implies that an instructor can help a learner to develop the ability to solve a given problem and analgous problems by (1) stimulating recall of applicable problem solution rules and (2) guiding thinking which develops an effective

planning strategy. The latter can be visualized as two discrete steps: helping the problem solver understand the goal of the activity (the desired outcome) and the general form that the solution might take.

The above paradigm assumes that the problem is already within the range of the learner's competencies. This may not always be the case. The instructor needs to evaluate the learner's readiness for the type of problem by being sure that prerequisite knowledge and intellectual skills exist. It may also be necessary to explicity teach cognitive strategies or an appropriate solution process for this type of problem. If the learner does not understand what the correct solution is, it should be demonstrated and instruction provided on how the learner should validate the correctness of his solution.

In a training situation in which a limited number of structured problems need to be solved, it is most efficient to teach the learner a solution paradigm. The learner needs to be able to recognize when to use the paradigm, usually by identifying cues or operating conditions which alert him to the existence of this category of problem. He needs to know what other factors need to be considered, what additional data may be needed to solve the problem, and where and how to get it. He also needs to learn a solution process which will help him organize and manipulate this information. The model needs to include activities, intermediate events,

and appropriate sequence.

Short and simple problem solution processes can be memorized for standard problems. The execution routine may be presented as a series of activities, a formula, a script, or a recipe. The learner must be able to perform all of the following at the given criterion level:

1. Recognize cue or situtation in which routine is appropriate.
2. Execute solution routine as learned.
3. Evaluate outcome.
4. If unsuccessful, select appropriate next step:
    A. Repeat routine.
    B. Execute alternative routine.
    C. Refer to appropriate person.

For more extensive problems, it may be more appropriate to teach the learner to use a problem solving check list, a flow chart, an input-output analysis technique, or other aid for solving the problem. It is often unnecessary to teach the learner the underlying theories or principles of why to perform the procedures, if adequate performance is insured simply by following the given problem solving procedures.

When problems encountered are less routine, the learner may need to learn higher-order rules for solving the category of problems. That is, he must learn a new solution paradigm. There is some evidence to suggest that it is better to teach solution paradigms through a discovery approach than through direct instruction of the paradigms.

This strategy requires the instructor to design a guided learning experience which enables the learner to observe or experience a chain of actions and outcomes from which he deduces the solution rule. The illustrations or experience can be further strengthened by using verbal cues and stimulating learners to verbalize the rule(s) they have discovered. Verbal prompts should be used during the learning process to guide the learner's thinking. These prompts remind the learner of analogous problems he may already know how to solve and may indicate procedures and/or information which will not be helpful or appropriate for solving the problem.

Larkin (1980) suggests two other strategies. A simplified version of the problems which retains its central features may be used as a guide for solving the original problem. A second strategy is to divide a large and complex problem into simpler subgoals whose solutions are more obvious to the learner. Having solved these, he is then able to plan an appropriate strategy to solve the original problem.

In a graduate course in problem solving and decision making strategies, several exercises were used to develop skills in solving structured problems. Even with graduate students, it was usually important to emphasize that the first step in problem solution was problem analysis. Students were urged to read the whole problem carefully and be

sure that they were able to answer these questions before attempting to solve the problem: What is the problem? How will you know when you have solved it? What information is available? What decision constraints are externally imposed?

Puzzles were useful to help students learn to organize existing information and infer additional information from known facts. For example, the solution to "Who Has the Afghan?" (see Appendix for the problem and model solution), can most easily be solved by developing a matrix of animals by owners. Givens are entered first, then hypotheses about other relationships are formulated and tested against information provided by the puzzle. Through a process of elimination, the single correct answer is isolated.

A more complex variation of this puzzle was used several weeks later in a group situation not unlike one which might be encountered in real life. Each of four or five group members received information related to solving the problem on randomly distributed cards. Some cards provided redundant information. Others had information which was correct but irrelevant to solving the problem. One card reminded participants that distance traveled was a function of velocity and time, the fundamental relationship for solving the problem.

Solution of the problem required development of an

appropriate way to organize the information. It also pointed to the need to motivate all group members in the task so that they would share their information with the group. Groups which failed to solve the problem either did not generate an appropriate data organizing plan, were unable to ignore irrelevant information presented by a forceful member or did not attend to a crucial piece of information. Effective groups began by identifying what the problem really was, designed a data collection matrix, and actively solicited information to fill in needed cells. (Game available from author on request.)

Additional exercises taught participants how to develop an input-output analysis and a problem check list. Improvement of problem solving efficiency was addressed by considering the cost of obtaining information needed to test various solution hypotheses. The most efficient strategy first rules out high probability problem sources and those that are easiest to test. The exemplar problem here was a lamp activated by a timer which failed to light at the indicated time. With only layman's knowledge of electricity, it is relatively easy to design an input-output model of the problem and to develop an adequate checklist of possible problem causes. (See the lamp problem in the appendix.)

Some discussion was given to structured problems where alternatives had varying degrees of risk. (See Wright,

1984) Depending upon the intellectual level and learning needs of students, a variety of mathematical approaches might be taught: decision trees, maximization/minimization problems, queuing theory, etc. Good examples of these types of solutions can be found in standard business texts.

Ill structured problems

There is general agreement that structured problem solving skills can be taught. However, as Frederickson (1984) pointed out in a recent literature review of cognitive theory related to problem solving, we can be much less certain about the adequacy of our knowledge as problems become increasingly ill-structured.

> We know little about how to teach students to develop representations of ill-structured problems, to develop plans for solving such problems, or to employ appropriate strategies or heuristic approaches. Still less can we advise students about efficient methods for accessing relevant information in long term memory.
> Frederickson (1984:396)

Social psychologists are less modest about their ability to facilitate creative problem-solving and rational decision making processes. For example, Van Gundy (1981) presents 70 different techniques which have been developed to improve skills in four major dimensions of problem solving and decision making: redefining and analyzing problems, generating ideas, evaluating and selecting among alternatives, and evaluating implementation feasability. Many of these techniques are applicable to ill-structured problems.

Another reason for being optimistic about the ability of adult educators to teach techniques for improving ill-structured problem solving capabilities is that normal adults have had to make decisions for many fuzzy problems. These learners, unlike young children, already have threshold level skills or better yet are rarely functioning at optimal levels. Frequent causes of poor quality decisions with a fuzzy problem arise from failure to clearly define the problem, generation of a limited range of alternatives, use of less than optimal criteria in the choice, and failure to note implementation problems.

The success of National College's course in problem solving and decision making skills indicates that fuzzy problem solving skills can be enhanced by increasing knowledge about theoretical foundations for decision making, learning structured techniques, and practice with relevant application exercises.

Exercises in defining and analyzing problems

Problems are identified through symptoms which indicate that there is a gap between what is and what one thinks ought to be. These symptoms are seldom the true problem, simply indicators that one may exist. Treating symptoms instead of problems is rarely the best strategy; such an approach may even exacerbate a problem. Failure to recognize the true nature of a problem also limits the ability to generate appropriate solution alternatives.

Graduate students found it very helpful to step back from premature search for a solution and consider the problem more fully. One group exercise, based on a student-generated mini-case, used the Goal Orienation Technique to identify what a parent really valued as an outcome when a teenage daughter and/or her friend was suspected of using marihuana. Before the exercise, the problem was defined as finding out whether this offense had indeed been committed. Initial suggestions for solution were authoritarian, negative, and showed lack of trust in the child. When use of the substance was seen as a secondary concern to the major goal of raising a physically and emotionally well child, a series of counseling, inquiring, and esteem-building approaches were suggested. (See appendix for a goal orientation exercise.)

Another technique which was popular was use of analogies. In the marihuana case, analogies were made to parental use of licit substances which could also be abused, to other types of behavior motivated by peer pressure, and to acting out behavior which is a thinly disguised call for help. Many of these analogies were useful in generating solution ideas as well as putting the problem in clearer perspective.

Problem definition can also be facilitated by identifying and explictly stating what is <u>not</u> the problem. Establishing problem boundaries can be especially helpful in group decision making because it shapes the solution alter-

natives which will be suggested and improves the ability of the group to focus on key issues. Dimensional Analysis is one technique which can be useful in limiting some types of problems. (See Van Gundy for suggestions on how to use this technique.)

Paradigms for organizing information, flow charting, and problem mapping techniques described earlier as strategies for structured problem solving may also be useful for analyzing structured problems.

Idea generating techniques

Another common weakness in many problem solving situations is adoption of the first acceptable solution without conducting a diligent search for the best alternative. Simon (1976) refers to this as satisficing, a technique which is appropriate when the cost of chosing a lesser-quality alternative is low and the search for a better alternative would not be cost effective. Many routine decisions fall into this category, such as purchasing food, selecting a book to read, or setting a date for a board meeting. However, when a decision has far-reaching consequences, whether a personal decision or a group decision, an adequate range of alternatives should be generated and evaluated.

Van Gundy listed 28 individual and group techniques for generating ideas, many of them variations of the familiar brain-storming approach. One variation used effectively by

the graduate students was the Collective Notebook Technique. The group was given a problem and each individual was asked to develop at least one possible solution each day and write it in a notebook. At the end of the time period, all ideas were combined into a collective notebook. Group activities then built upon the ideas in the collective notebook. The extended time period improved quality of suggestions and privacy may have encouraged more participation from less confident members of the group.

In real-life situations, alternatives can be generated by active search as well as creative thinking. Depending upon the problem, any of the following might be appropriate: use of a consultant, a review of the literature, interviews and/or on-site visits with people or organizations which may have solved a similar problem, or learning about new products by contacting vendors. Instruction in this type of information gathering is particularly appropriate in adult education.

Techniques for making better choices

Several easy to use decision techniques are based on an assessment of advantages and disadvantages of each solution alternative. Major factors influencing the decision are listed and each alternative is then rated as being plus, minus, or neutral on the factor. Alternatives can also be rated on other dimensions, such as ease of implemention or extent that the proposed change deviates from the status

quo. For group decisions, voting or ranking of alternatives might be used.

Janis and Mann (1977) developed a rating matrix which focuses on gains and losses for significant others as well as for the decision maker or decision making group. Each alternative is rated plus or minus on key attributes which are grouped by four dimensions: tangible gains and losses for self, for others, self-approval/disapproval, and social approval/disapproval. A Decision Balance Sheet exercise has been included in the appendix.

The graduate students also experimented with several more sophisticated approaches to evaluating alternatives. From the Battelle Method (Van Gundy, 1981:150-3) they learned to consider the cost in time, effort, or money to screen ideas. Battelle first applies low cost screens, defined as those which can eliminate alternatives not meeting the decision criteria at very low cost. Remaining alternatives are screened again with more costly screens, such as empirical testing. There can be several iterations of the process until only a few alternatives remain for indepth analysis.

Weighting systems were also explored but proved to be of limited interest to this group of students. Although systematic techniques exist for assigning numerical weights to qualitative factors, many adults seem to resist attempts to quantify values or preferences. For people who are accus-

tomed to working with figures, very sophisticated techniques can be used which look simultaneously at preference and probability of success. (See Wright, 1984 for a layman's introduction to expected subjective utility.)

Techniques for identifying implementation blocks

Identification of blocks to implementation of a given course of action may well be thought of as part of the process of making the decision. It is obvious that no matter how attractive a potential solution is, it must not be chosen if the indicated course of action cannot be successfully carried through. Consideration of implemention difficulties assures that the chosen solution is also the best or most appropriate solution for the given problem in the given situation.

A useful and easy to learn approach is based on use of a checklist which reminds the decision maker(s) to consider whether adequate time, personnel, facilities, and other needed resources are available. In many situations, it is also important to include a review of policies, traditions, and advocates/resisters to the proposed change in such a checklist.

A graphic display of the relative strengths of driving and restraining forces affecting a given course of action can be shown using a Force Field diagram. The magnitude of the force of each vector can be indicated by its length or by its width. This type of analysis is particularly useful

in helping decision makers devise strategies to overcome resistance to a proposed change. The original work on force field analysis was done by Lewin (1938) but a fine description can be found in more current books, such as Moody (1983).

Kepner and Tregoe's (1976) Potential Problem Analysis is a powerful approach for anticipating problems. It involves preplanning to prevent or minimize problems and development of contingency plans if crucial project events have a high probability of encountering a problem. An initial analysis asks what potential problems might arise. Further analysis of each potential problem includes identification of where, when and probable cause. Later refinements of the method have included estimates of probability of occurence, serious-ness of the problem, preventive actions that might be taken, residual probability of problem occurence if preventive action is taken, the cost of the preventive action, and the cost of a contingency plan to deal with worst case conditions. (See Van Gundy 1981)

Other sophisticated implementation evaluation procedures could be used, such as PERT (Program Evaluation and Review Technique) or models developed by organization behavior theorists to evaluate level of support for organizational change. Details on these procedures can be found in appropriate management texts or related literature.

The graduate students clearly prefered Force Field Ana-

lysis because it is relatively simple to conceptualize and alerts decision makers to both threats and opportunities. This technique was used with a student-generated mini-case on alternatives available to a community service facing radical changes in its fight for survival. The technique is easy to explain and can be used with unsophisticated but perceptive lay people. The more detailed Potential Problem Analysis technique obviously requires a high level of expertise with the technique plus detailed knowledge about the situation. It was used with a small problem and appears as an exercise in the appendix.

Concluding observations

Teaching fairly sophisticated adult learners how to improve their own problem solving and decision making skills and to teach these skills to others was an interesting and rewarding effort. A moderate level of theory was introduced, time had to be allocated to instruction in the various techniques, but there was a high level of group involvement in utilizing and evaluating techniques.

It would have been helpful to have had a text which covered all of the desired material. However, handouts and mini-lectures were developed to present important concepts introduced by Janis and Mann, Simon, Lewin, and others. Vroom and Yetton's (1973) model was presented for analysis and discussion of conditions under which decisions should be made by a group rather than by an individual.

Since some of the students work in human service agencies, it was important to point out psychological barriers to effective decision making. Examples were discussed which illustrated situations in which a counseling technique would be more effective than use of a rational decision making model. Janis and Mann (1977) was particularly helpful in developing notes for this session.

One caveat should be given about teaching the techniques in isolation, that is, as not part of the entire problem solving process. Design of the course was facilitated by presenting a series of techniques for the same problem solving phase during the same session. However, some students found it difficult to relate the product of a limited segment of the decision process to the process as a whole. In the future, exercises will be designed so that, in so far as possible, it is clear that the product of one technique, such as problem analysis, is to be used as input in the following step of generating alternatives.

In the final analysis, the effort to develop an experimental course to teach problem solving and decision making skills was highly successful. Even those students who are confirmed Gestaltists admitted that there are some advantages to using an analytical approach, especially for well structured prolems. And, even the most pragmatic among us accepted the role of intuition. After a diligent information search and vigilant screening of alternatives, the final decision may still need to be based on the holistic inter-

action of mind, body, and feelings that we call intuition or gut reaction. Informed intuition may well be the optimal strategy for making wise decisions.

Use of structured techniques and a complete decision making process improves native problem solving abilities and leads to better choices even when the final judgment is made with informed intuition.

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APPENDIX

OF

PROBLEM SOLVING AND DECISION MAKING TECHNIQUES

AND

RELATED LEARNING ACTIVITIES

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LEARNING EXERCISES FOR IMPROVING PROBLEM SOLVING SKILLS

WHO OWNS THE AFGHAN?

Puzzles are structured problems if they have only one solution and there are one or more solution paradigms. The complexity of a puzzle usually lies in its presentation. It may be deliberately represented in such a way as to mislead. Information may be presented in a format that confuses the puzzle solver about what is and what is not. Since both types of problem representations puzzle real life problem solvers, useful skills in problem analysis and information organization can be learned by solving puzzles.

In the following puzzle, all needed information is provided but in a manner which obscures the answer. When the it is displayed in an appropriate array, the solution is readily apparent.

Read the following paragraph. Then create an organizing schema so that you can discover who owns the afghan.

The dogs and their owners

Toby's dog almost got into a fight with Bob's terrier. Alan's dog has arthritis. Marge and Toby are engaged. Sherry's dog and Nat's dog are afraid of the scotty. Nat's dog is badly overweight. The owners of the terrier, the poodle, and the dalmatian are married. The afghan, the poodle, and the terrier are in perfect physical condition. Toby's dog bit the afghan. Nat is a bachelor. Each person owns exactly one dog. One of the dogs is a setter.

Solution for Who Owns the Afghan?

The easiest way to conceptualize the problem is to create a data matrix which matches dogs and owners. Pieces of information are entered and the solution arrived at by a process of elimination.

	Terrier	Scotty	Poodle	Dalmation	Afghan	Setter
Toby	N	(Y)	N	N	N	N
Bob	(Y)	N	N	N	N	N
Alan	N	N	N	(Y)	N	N
Marge	N	N	N	N	(Y)	N
Sherry	N	N	(Y)	N	N	N
Nat	N	N	N	N	N	(Y)

1. Toby does not have the terrier. Enter N in the appropriate cell.
2. Bob has the terrier; class out by entering N in all other cells down the column and across the row.
3. Sherry and Nat don't have the scotty.
4. Marge and Toby are single; they can't own terrier, poodle or dalmation.
5. Toby doesn't have an afghan; the dog he owns bit it.
6. Nat is single so can't own a terrier, poodle or dalmation.
7. Alan's dog is ill; it can't be an afghan, poodle or dalmation.
8. Sherry is the only person who can own the poodle; class out.
9. Alan is only one who can own the dalmation; class out.
10. Nat's dog is overweight so cannot be an afghan, poodle or terrier. Nat must own the setter; class out.
11. Tobby owns the scotty. Class out.
12. With only one spot left, Marge must own the afghan.

THE LAMP PROBLEM

Several skills can be taught with the following problem.

- Problem analysis
  - Input/output analysis and/or flow charts
  - Identification of sub-systems
- Problem check list
- Problem search strategies
  - Cost of test (include time, effort, $ costs)
  - Probability of identifying problem cause
- Importance of using relevant knowledge and available data

Lamp Problem

A homeowner entered the living room at 10:15 p.m. and saw that the lamp was off. It should have been turned on by a timer at 10 p.m. What is the problem?

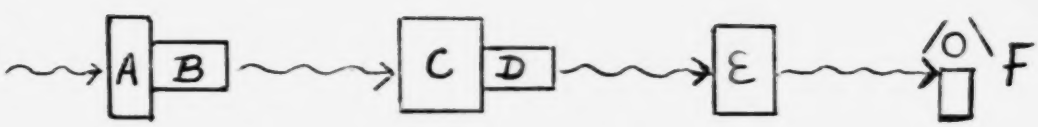
Goal: Light will go on at 10 p.m.

Data: Electric service to house is okay.

Prerequisite knowledge:

1. Good lamp bulb lights when electricity flows to it.
2. Electric flow may be interrupted by switches or loss of contact.

INPUT/OUTPUT DIAGRAM



A	wall outlet	D	lamp plug
B	timer plug	E	lamp switch
C	timer	F	light bulb

PROBLEM CHECK LIST

$	Pr	main system	$	Pr	timer	$	Pr	lamp
M	L	circuit breaker	L	M	plug	L	M	plug
M	L	outlet	L	M	setting	L	M	switch
			H	L	mechanism	M	H	bulb

$ = cost of screen Pr = probability of problem occurence

USE OF SCREENS TO INCREASE PROBLEM SEARCH EFFICIENCY

COST: High: time consuming or high dollar cost to test

Medium: some time and effort needed

Low: visual inspection or very easy

PROBABILITY: High: problem occurs frequently

Medium: sometimes causes a problem

Low: rarely causes a problem

STRATEGY: Initial tests or problem analyses should focus on problem sources which are relatively frequent and easy to check out. Decide on sequencing of additional checks by considering both probability that the problem source will be identified by the test and the cost or ease of testing. It is important to point out that the most efficient strategy may not be to start at the beginning of the sequence and work to the end, or vice versa.

SOLUTION: Taking the timer to the repair shop first would obviously be a low efficiency strategy. One might begin with a quick visual inspection to be sure that everything is plugged in, timer set appropriately, and light switch on. The lamp as a subsystem should be examined next.

GOAL ORIENTATION

Goal orientation exercises should be used when a problem is being very narrowly defined. It is particularly effective in helping people move to higher levels of considering the problem, perhaps in terms of long term consequences or second order effects. It is analogous to thinking about winning the war instead of trying to win a minor battle which may cost far more than it is worth. In group exercises, participants may be asked to consider the problem in relation to the organization or agency's mission or long range plan. Problem solvers are asked to focus on broader outcomes and congruence of outcomes with values rather than limiting consideration to specific processes or products related to the decision at hand.

Goal orientation exercise

Read the job decision case. Assume that Susan has the same values and life fulfillment needs that you have. Now, play the role of Susan and do the exercise.

1. Write down a general description of the problem.

2. Write a statement describing what you want to accomplish. It should be consistent with your personal values and your needs for achievement, affiliation, and authority. Another way to look at it would be to project into the future and picture yourself as very happy with your decision. Identify the factors in your new life that have made you happy. Use this information to describe the outcome you hope to achieve from this decision.

3. Redefine the problem in terms of reaching goals.

4. What constraints are externally imposed on your decision? (These constitute barriers which you cannot overcome; they identify the parameters in which the decision must be made.)

5. What obstacles keep you from reaching your goals? (Obstacles are often removable or can be circumvented by careful planning.)

6. Search for solutions to the problem which will:

    a. enable you to fulfill your needs/ reach goals

    b. fit within constraints

    c. overcome or circumvent obstacles

CAREER CHOICE CASE

Susan Smith is 34, married to Harry who is an accountant, and has two children in grade school. She returned to college and will soon complete her MBA. Because of an outstanding academic record, she has received several job offers and is trying to decide which one to take.

A. Management trainee in a Fortune 100 company which is growing rapidly. This prestigious two year training program will require her to move to Texas. The company has an excellent reputation for promoting women to higher management positions. In addition, training program graduates have moved on to exciting management positions with other firms.
   Salary: $30,000 plus relocation expenses for the family.

B. A local industry offers a management level position in personnel/human resource management. It is a good place to work but family always holds the top management positions.
   Salary: $32,000.

C. Executive director of the non-profit agency where Susan had been an active volunteer. A high level of autonomy; flexible hours.
   Salary: $26,000.

As she thinks about her choices, Susan is aware that the management training program must be taken now or never. In fact, after 35 she may not be able to move to the "fast track" in a major corporation. Relocation wouldn't be easy, but Harry would have little difficulty finding work as an accountant. The children are still young enough to adapt quickly. It would be safe and comfortable to return to the non-profit agency. But, the salary will never match private industry and she is also sure that flexible hours will also mean that she'll have to work evenings and weekends. At times Susan even wonders if a wife and mother should be thinking about a high level career in a big company. Maybe she should take the job in the local industry as it offers good pay and regular hours. But, wouldn't it soon become just another boring, dead end job?

JANIS AND MANN'S DECISION BALANCE SHEET

Janis and Mann (1977) believe the expected consequences of a decision should be evaluated on four dimensions:

1. utilitarian gains and losses for self
2. utilitarian gains and losses for significant others
3. self-approval or -disapproval
4. approval or disapproval from significant others

Utilitarian considerations include both tangible and intangible benefits. Approval/disapproval entries arise from moral and ethical value judgments about the decision, ego needs, or self-image. Reactions of significant others should be considered as they are important factors in satisfaction with decisions.

An example of a decision balance sheet is shown on the following page. It is completed by entering the factors which will be used in making the choice and rating each alternative on each factor. The completed balance sheet quickly highlights which alternative has more positive consequences and which is expected to have the most negative consequences. Consideration should also be given to the importance of each factor; a highly valued outcome may more than compensate for several negative outcomes of less importance.

Exercise with Decision Balance Sheet

Read the job decision case. Imagine that you are Susan and complete a balance sheet for each of the three alternatives. If you have a number of entries in a given cell, you may want to consider only the four most important factors.

TABLE 3. **A schematic balance sheet grid for conceptualizing decisional conflict.** *(Based on Janis, 1959.)*

TYPES OF ANTICIPATION *with examples from research on career conflicts of lawyers*	ALTERNATIVE COURSES OF ACTION					
	Alternative 1 (e.g., job with Department of Justice)		*Alternative 2 (e.g., job with a Wall Street firm)*		*Alternative 3 (e.g., private practice in a small town)*	
	+	−	+	−	+	−
A. Utilitarian gains or losses for self 1. Personal income 2. Interest value of daily work 3. Opportunity to live in a preferred city . . n						
B. Utilitarian gains or losses for significant others 1. Social status for family 2. Reducing political corruption in community 3. Advancing civil rights for nation . . n						
C. Self-approval or -disapproval 1. Moral considerations pertaining to ethical legal practices 2. "Ego ideal" of being an independent thinker 3. Self-image as defender of innocent people . . n						
D. Social approval or disapproval 1. From wife (or husband) 2. From close friends 3. From a national professional organization . . n						

The cells in this schematic grid should be visualized as being filled with positive (+) and negative (−) entries of varying magnitude depicting the strength of the incentives to accept or reject each alternative. The purpose of filling out the grid is to predict vulnerability to subsequent setbacks by identifying the main sources of conflict. Ordinarily the grid is set up with the rows representing the alternative courses of action; the rows and columns are reversed in this table in order to list examples of subcategories within each of the four types of anticipations.

from Janis and Mann (1977) page 138

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POTENTIAL PROBLEM ANALYSIS

Simply making the best decision is not enough; identifying an action plan to carry it out is an essential part of the problem solving and decision making process. This plan specifies the processes and outputs which are necessary to the success of the decision. In an uncertain world, it helps planners adapt for Murphy's law and the Peter principle.

A formal approach to potential problem analysis has been developed by Kepner and Tregoe (1976). It helps identify the precise nature of each potential problem, an assessment of the likelihood that it will occur, its causes, ways to prevent or reduce its effects, and contingency planning. Ideally, PPA is done before the decision is made because alternatives which will be very difficult to move to action may need to be eliminated from active consideration. It is particularly important to do a PPA when (1) something new or complex is involved; (2) there is little slack time in the implementation schedule; (3) many people, activities, or organizational units are involved; or (4) lines of responsibilities are ambiguous.

The process of beginning a potential problem analysis is begun by generating a list of all events which must take place before the objective is reached. This is similar to the activities and events which would be entered on a PERT chart.

The next step is to go down the list and identify

potential problems and indicate what, where, and when a problem might occur. The decision maker now estimates both the probability that the problem will occur, and the seriousness of its consequences. A risk level is estimated for each problem by jointly considering the probability that it might occur and the seriousness of its consequences. Since this is usually based on subjective rather than objective analysis, this is expressed as a number rating within an arbitrary range, usually from 1 to 7 or 9.

All high risk potential problems should be further analyzed for probable cause and for the probability that the problem causing event will occur. Subsequent analysis steps look at whether underlying causes of problems can be eliminated or attenuated. Contingency plans are then developed to deal with the most serious and probable problems.

POTENTIAL PROBLEM ANALYSIS APPLICATION EXERCISE

Assume that Susan, our career woman, is seriously considering the position which requires a move to Texas. Based on your own experience and knowledge about moving, use the paradigm below to do a potential problem analysis on relocating the family. This information is used to make a choice and, later, to plan the implementation process.

PROB. CAUSE	p°	PREVENTIVE ACTIONS	RP	CONTINGENCY PLAN

p°=probability of problem causing event occuring
RP=remaining probability after preventive action